

# Estuarine Habitats

## STANDARDS

### Science-1999 Grade Level(s): 6

**Status:** This curriculum is currently implemented by DPI but is not yet tested. Refer to an earlier version for the currently tested curriculum.

- 2 The learner will investigate the characteristics of matter and energy flow through an ecosystem.**
- 2-1 Examine evidence that plants convert light energy into stored energy which the plant, in turn, uses to carry out its life processes.
  - 2-2 Differentiate between the interconnected terrestrial and aquatic global food webs.
  - 2-3 Describe ways in which organisms interact with each other and with non-living parts of the environment:
    - Limiting factors.
    - Coexistence/Cooperation/Competition.
    - Symbiosis.
  - 2-4 Evaluate the consequences of disrupting food webs.

### Science-1999 Grade Level(s): 8

**Status:** This curriculum is currently implemented by DPI but is not yet tested. Refer to an earlier version for the currently tested curriculum.

- 2 The learner will build an understanding of population dynamics.**
- 2-2 Conclude that some ecosystem resources are finite.
  - 2-3 Explain how changes in habitat may affect organisms.
  - 2-4 Analyze practices that affect the use, availability, and management of natural resources:
    - Land use.
    - Urban growth.
    - Manufacturing.

### Science: Biology (multi-grade level, most likely 9<sup>th</sup> and 10<sup>th</sup>)

#### ▼ Goal 4

The learner will develop an understanding of ecological relationships among organisms.

#### Objective 4-1

Identify the interrelationships among organisms, populations, communities, ecosystems, and biomes.

#### Objective 4-3

Explain the flow of energy through ecosystems.

#### ▼ Goal 5

Students will develop an understanding of the behavior of organisms, resulting from a combination of heredity and environment.

#### Objective 5-1

Evaluate the survival of organisms and suitable adaptive responses to environmental pressures.

### **Objective 5-2**

Assess and examine ecosystems, and biomes and other responses.

### **Objective 5-5**

Evaluate and explain the evolution of behavioral adaptations and survival of populations.

## **NATIONAL STANDARDS:**

List of Benchmarks for Science (4<sup>th</sup> Ed.)

### **Level III (Grades 6-8)**

1. Knows that all individuals of a species that exist together at a given place and time make up a population, and all populations living together and the physical factors with which they interact compose an ecosystem.
2. Knows factors that affect the number and types of organisms an ecosystem can support (e.g., available resources; abiotic factors such as quantity of light and water, range of temperatures, and soil composition; disease; competition from other organisms within the ecosystem; predation)
3. Knows ways in which organisms interact and depend on one another through food chains and food webs in an ecosystem (e.g., producer/consumer, predator/prey, parasite/host, relationships that are mutually beneficial or competitive).
4. Knows how energy is transferred through food webs in an ecosystem (e.g., energy enters ecosystems as sunlight, and green plants transfer this energy into chemical energy through photosynthesis; this chemical energy is passed from organism to organism; animals get energy from oxidizing their food, releasing some of this energy as heat)
5. Knows how matter is recycled within ecosystems (e.g., matter is transferred from one organism to another repeatedly, and between organisms and their physical environment; the total amount of matter remains constant, even though its form and location change).

### **Level IV (Grades 9-12)**

1. Knows how the interrelationships and interdependencies among organisms generate stable ecosystems that fluctuate around a state of rough equilibrium for hundreds or thousands of years (e.g., growth of a population is held in check by environmental factors such as depletion of food or nesting sites, increased loss due to larger numbers of predators or parasites).
2. Knows how the amount of life an environment can support is limited by the availability of matter and energy and the ability of the ecosystem to recycle materials.
3. Knows ways in which humans can alter the equilibrium of ecosystems, causing potentially irreversible effects (e.g., human population growth, technology, and consumption; human destruction of habitats through direct harvesting, pollution, and atmospheric changes)

## Vocabulary

aquatic	decomposer	flora	producer
barrier island	detritus	fauna	salinity
brackish	ecology	habitat	substrate
consumer	estuary	maritime forest	terrestrial

## Objectives

- To be able to identify the major habitats in the estuary and list the primary characteristics of each habitat.
- To be able to state the role of the producers, consumers, and decomposers.
- To be able to compare aquatic habitats to terrestrial habitats.
- To be able to describe how physical factors shape or limit coastal habitats.
- To be able to list the primary limiting factors for coastal flora and fauna.
- To be able to predict which habitat a particular plant or animal will occupy if given some of the limiting factors.

## Materials

- Reference books, textbook, dictionary and field guides
- *If access to Internet*, use Estuary Live website, with Estuarine Plant and Animal Factsheets (also will be available to print out)

## Procedure

- Read introduction and discuss the Barrier Island Complex graphic (Figure 1). If you have access to the Internet you may want to show pictures of these habitats or use the Estuary Live video.
- Tables 1 is an introductory activity and looks at basic habitat characteristics and naming species who occupy them.
- Tables 2, and 3 can be done by each student or in small groups, research what the specific needs are for species of flora and fauna.
- Table 4 is a summary and assessment tool to use the information they have gathered and to list species in each habitat by their needs.

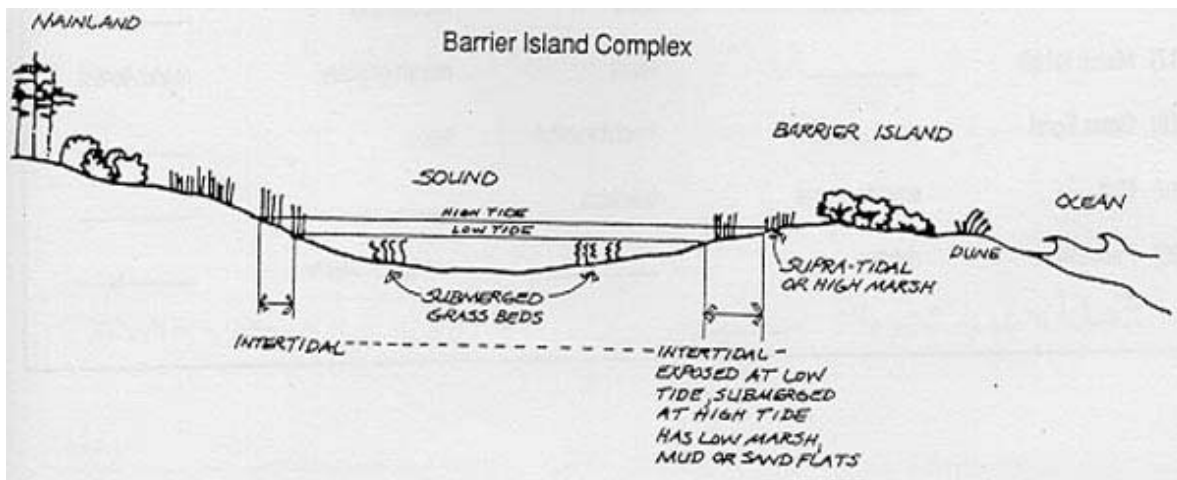
## Introduction

**Ecology** is the study of the relationships between plants and animals and the environment in which they live. The **estuary**, with its mixture of fresh and salt waters, is one of particular interest to students of ecology. A number of factors limit the type of organism that can be found in each part of the estuary. These factors include: **salinity** (saltiness), presence or absence of water, type of soil or substrate, availability of food or shelter, temperature, currents, and availability of light. One set of factors may be more likely to affect plants and another set may limit the distribution of animals.

Animals are considered to be **consumers** because they are unable to make their own food and must consume food manufactured by another organism. A special type of consumer is the **decomposer**. These organisms (usually bacteria and fungi), breakdown dead plants and animals and release the once living materials back into the environment. Imagine what the world would look like if everything that ever died remained in the form it had when it died – the earth would be littered with carcasses! Plants are **producers** because they can make their own food, trapping light by means of photosynthesis. Producers may be tiny microscopic plants or large trees.

North Carolina coasts are lined with a series of **barrier islands** that border the sound. The estuary exists behind these barrier islands wherever freshwater meets the ocean and generally creates **brackish** conditions. These barrier islands have a variety of habitats or places available for organisms to live and include **aquatic** (water) habitats and terrestrial (land) habitats. The chart lists the major types of habitats and the characteristics of each habitat. Each different habitat will support a particular set of producers and consumers.

Figure 1:



**Table 1:**

Give examples of fauna (animals) and flora (flora) found in each of the major coastal habitats:

Coastal Habitats		
Type of habitat	Characteristic	examples of <b>fauna</b> and <b>flora</b>
<b>Beach</b>	Presence of the surf and waves High salinity Abundant oxygen High temperatures Little cover Strong winds	ex. Coquina clams
<b>Dunes</b>	Loose shifting sand Strong winds Little available water Moderate salinity due to salt spray High temperatures and abundant light	
<b>Salt Marsh</b>	Brackish water Affected by tides Large temperature and salinity changes High nutrients Low available oxygen	
<b>Mud Flat</b>	High salinity Mud and sand bottom (substrate) Little protective cover Affected by tides Large temperature and salinity changes	

## Activity: HABITATS

**Table 2:**

Use your knowledge of coastal animals and plants to complete the charts on consumers and producers. Refer to reference materials as needed.

Consumers	Food	Water	Shelter	Habitat
1) flounder	fish/crustaceans		sand/mudbottom	
2) pelican		brackish/salty	water/beach	
3) ghost crab	coquina clams	fresh/salty		
4) gull		fresh/salty	dunes	
5) grasshopper	marsh grasses			marsh
6) oyster	detritus/plankton		hard substrate	
7) blue crab		salty/brackish	mud/sand	
8) lizard			trees/shrubs	forest
9) osprey			trees	rivers/sounds
10) mosquito		fresh/brackish	water/grasses	marsh/forest
11) tree frog	insects			forests
12) mouse			forest/grasses	marsh/forest
13) marsh wren		fresh/brackish	marsh/grasses	
14) fiddler crab	detritus	brackish		
15) warbler		fresh		forest
16) starfish		salty	rocks/sand	
17) marsh rabbit		fresh	marsh grasses	marsh/forest
18) great egret		fresh/brackish	trees	
19) rail	aquatic plants	brackish		
20) periwinkle	detritus		cordgrass stems	
21) saltmarsh skipper			marsh grasses	marsh

**Table 3:**

Producers	Salinity	Light	Moisture	Substrate	Habitat
1) diatom	fresh/salt	high		water	ocean/sound
2) pennywort	mildly salty	moderate to high	moderate	sand/soil	
3) glasswort		high	moderate/high		marsh
4) wax myrtle	fresh	high		sand/mud	maritime forest
5) sea oats	salty		minimal	sand	
6) salt marsh cordgrass	salty	high	high	sand/mud	
7) sea lettuce	salty	moderate	aquatic	shells/rocks	
8) eel grass	salty	moderate		sand	ocean/intertidal
9) black needle rush	brackish	moderate to high	high	sand/mud	
10) live oak	fresh	high		soil	maritime forest

**Table 4:**

Use the information given in the coastal habitat descriptions, the producer and consumer charts and reference materials to complete the table below.

Habitat	Fauna (animals)	Flora (plants)
Marsh		
Mudflat		
Ocean		
Dunes		
Beach		

## Discussion Questions

1. Three crabs that occupy different habitats were listed in the consumer chart. How are the living requirements different for these three crabs? Why are they found in different habitats?
2. How does water salinity affect the habitat available for consumers to use?
3. Which plants are able to survive in areas of high salinity?
4. Which coastal habitats are characterized by having high salinities?
5. Name three animals that are occasional visitors to the salt marsh, ocean or sound but are primarily terrestrial.
  - A. \_\_\_\_\_
  - B. \_\_\_\_\_
  - C. \_\_\_\_\_
6. Which factors appear to limit where a plant can survive?
7. Which environment could be considered the most hostile to plant growth?
8. List three ways a maritime forest is different from the sand dunes?
  - A. \_\_\_\_\_
  - B. \_\_\_\_\_
  - C. \_\_\_\_\_
9. Suggest several reasons to explain why American Indians tended to settle on the landward side of the marsh rather than on the dunes or beach.



## **Estuarine Habitats**

### **Teacher Information**

#### **QUESTIONS AND ANSWERS**

1. Three crabs that occupy different habitats were listed in the consumer chart. How are the living requirements different for these three crabs? Why are they found in different habitats?

**Each crab has developed adaptations that enable them to occupy different habitats and utilize different food sources. The blue crab lives in water with varying salinity, the ghost crab is essentially terrestrial and lives on the dunes and beach, the fiddler crab lives in the marsh on mud flats.**

2. How does water salinity affect the habitat available for consumers to use?

**Many animals can only survive a particular range of salinity and are limited to living in areas with those salinities.**

3. Which plants are able to survive in areas of high salinity?

**Glasswort, salt marsh cord grass, eel grass, and sea lettuce (along with others like mangroves that were not mentioned)**

4. Which coastal habitats are characterized by having high salinities?

**Beach, marsh ocean**

5. Name three animals that are occasional visitors to the salt marsh, ocean or sound but are primarily terrestrial.

**A. warbler B. rabbit C. mouse**

6. Which factors appear to limit where a plant can survive?

**Water availability, salinity, light, and substrate**

7. Which environment could be considered the most hostile to plant growth?

**Beach**

8. List three ways a maritime forest is different from the sand dunes?

**A. more soil – less sand B. lower salinity C. more moderate temperatures**

9. Suggest several reasons to explain why American Indians tended to settle on the landward side of the marsh rather than on the dunes or beach.

## Additional Resources

- **Use the Estuary Plant and Animal Fact sheets** (these are available on the Internet at <http://www.estuarylive.org> or <http://www.estuary.gov> ) to supplement the information regarding the flora and fauna listed in this activity. These Fact sheets include some of the major plant and animal species that occur along the North Carolina coast. You may want to assign flora and fauna species not listed in this activity and have students research the specific needs of each species.
- **Use the EstuaryLive streaming video** (this is available on the Internet at <http://www.estuarylive.org> ) to enhance the discussion of the communities and flora and fauna that live in these.
  - If you participate during the live broadcast during the National Estuaries Day in the fall or use the archived footage on the above webpage, students will be able to see many of the communities, plants and animals studied during this lesson.

### History of EstuaryLive (from <http://www.estuaries.gov/welcome.html> )

- EstuaryLive, an interactive field trip through our nation's estuaries over the Internet, was the featured event for National Estuaries Day 2002.
- On October 3 and 4, 2002, teachers and students of all ages toured 13 estuaries, learning about these dynamic coastal ecosystems, the different types of estuaries that can be found along the coasts, the plants and animals that call these habitats home, and about the commercial and recreational importance of estuaries. Approximately one million viewers watched EstuaryLive on October 3 and 4.
- During the program, naturalists from NOAA's National Estuarine Research Reserves and U.S. EPA's National Estuary Program led live tours through seven estuaries, including Pamlico Sound, in North Carolina; South Slough, in Oregon; Salish Sea, in Washington; North Inlet, in South Carolina; Charlotte Harbor, in Florida; Great Bay, in New Jersey; and Jug Bay in Maryland. Elmer's Island in Louisiana was scheduled to air live on October 3, but was cancelled because of Hurricane Lili.

## Assessment

- Have each student chose a estuarine species that was not used in this activity and write a summary of the specific needs of that species in the habitat they live in.
- This activity is from the North Carolina National Estuarine Research Reserve publication Project Estuary. It is revised in August 2003, by NC National Estuarine Research Reserve and the Albemarle-Pamlico National Estuary Program for use with EstuaryLive, live interactive Internet programs about North Carolinas estuaries.



North Carolina National Estuarine Research Reserve  
[www.ncnerr.org](http://www.ncnerr.org) or tel. 252.728.2170

Albemarle-Pamlico National Estuary Program  
[www.apnep.org](http://www.apnep.org) or tel. 252.946.6481

